



INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁵ : A47C 7/74, H05B 133/34	A1	(11) International Publication Number: WO 94/09684 (43) International Publication Date: 11 May 1994 (11.05.94)
(21) International Application Number: PCT/SE93/00896 (22) International Filing Date: 28 October 1993 (28.10.93) (30) Priority data: 9203165-7 28 October 1992 (28.10.92) SE 9302785-2 26 August 1993 (26.08.93) SE (71) Applicant (for all designated States except US): SCAND- MEC AB [SE/SE]; P.O. Box 504, S-565 28 Mullsjö (SE). (72) Inventors; and (75) Inventors/Applicants (for US only) : LIVIKEN, Börje [SE/ SE]; PI 737 Liane, S-672 00 Ärjäng (SE). WIDEN, Torgny [SE/SE]; PI 1045, S-672 00 Ärjäng (SE). (74) Agents: GRAUDUMS, Valdis et al.; Albihn West AB, P.O. Box 142, S-401 22 Göteborg (SE).		(81) Designated States: AT, AU, BB, BG, BR, BY, CA, CH, CZ, DE, DK, ES, FI, GB, HU, JP, KP, KR, KZ, LK, LU, LV, MG, MN, MW, NL, NO, NZ, PL, PT, RO, RU, SD, SE, SK, UA, US, UZ, VN, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG). Published <i>With international search report.</i> <i>In English translation (filed in Swedish).</i>
(54) Title: HEATING ELEMENT FOR VEHICLE SEATS AND METHOD FOR MANUFACTURING OF A HEATING ELEMENT		
(57) Abstract Heating element for vehicle seats consisting of an electrically conducting heating loop (2), connectable to a current source, and a carrier (3) for the heating loop. The carrier (3) is air-permeable and made in an electrically insulating, flexible material and the heating loop is positioned on the carrier in a determined position relative to the carrier. The invention relates also to a method for the production of the heating element (1). An adhesive film is continuously unwound in the stage of a material web, an adhesive layer is applied to one of its sides, heating loops (2) are placed with chosen intervals, a further film (4) is continuously unwound in the shape of a material web and is connected to said first material web with the heating loops placed therebetween. One of the material layers is perforated with a plurality of holes (7) over its surface. Interruption indications or interruptions occur to separate heating elements.		

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AT	Austria	GB	United Kingdom	MR	Mauritania
AU	Australia	GE	Georgia	MW	Malawi
BB	Barbados	GN	Guinea	NE	Niger
BE	Belgium	GR	Greece	NL	Netherlands
BF	Burkina Faso	HU	Hungary	NO	Norway
BG	Bulgaria	IE	Ireland	NZ	New Zealand
BJ	Benin	IT	Italy	PL	Poland
BR	Brazil	JP	Japan	PT	Portugal
BY	Belarus	KE	Kenya	RO	Romania
CA	Canada	KG	Kyrgyzstan	RU	Russian Federation
CF	Central African Republic	KP	Democratic People's Republic of Korea	SD	Sudan
CG	Congo	KR	Republic of Korea	SE	Sweden
CH	Switzerland	KZ	Kazakhstan	SI	Slovenia
CI	Côte d'Ivoire	LI	Liechtenstein	SK	Slovakia
CM	Cameroon	LK	Sri Lanka	SN	Senegal
CN	China	LU	Luxembourg	TD	Chad
CS	Czechoslovakia	LV	Latvia	TG	Togo
CZ	Czech Republic	MC	Monaco	TJ	Tajikistan
DE	Germany	MD	Republic of Moldova	TT	Trinidad and Tobago
DK	Denmark	MG	Madagascar	UA	Ukraine
ES	Spain	ML	Mali	US	United States of America
FI	Finland	MN	Mongolia	UZ	Uzbekistan
FR	France			VN	Viet Nam
GA	Gabon				

HEATING ELEMENT FOR VEHICLE SEATS AND METHOD FOR MANUFACTURING
OF A HEATING ELEMENT.

TECHNICAL FIELD:

10 The present invention relates to a heating element for
vehicle seats according to the preamble of the appended
patent claim 1.

15 The present invention also relates to a method for manu-
facture of heating elements for vehicle seats according to
the preamble of the appended patent claim 10.

STATE OF THE ART:

20 It is known earlier to produce heating elements for vehicle
seats based on an electrically conductive heating loop
inserted between two layers of material. For certain
vehicles, manufacturing methods for vehicle seats have been
developed, where the upholstery layer is glued to the
25 elastic body of the seat cushion, usually made from plastic
foam. The use of conventional heating elements together
with this manufacturing technique involves certain
problems. The glueing of the upholstery will not be
homogenous in the heating element area, as the thickness of
30 said elements may cause their contours to be seen and
sensed on top of the upholstery layer. Furthermore, special
measures must be taken in order to obtain adhesion on both
sides of the heating element.

35 Through EP 227 202 a special method is known, whereby a
foil of glue between the upholstery layer and the elastic

5 plastic foam body is brought to melt through heating and to diffuse into the adjacent layers in order to join them together. Conventional heating elements cannot be used in connection with this known method as the heating element forms a barrier against glue penetration into the upholstery layer and also against the application of vacuum, which is used during realization of said method.

10 The object of the present invention is to provide a heating element which is material saving, and thereby space- as well as cost-saving, and allows integration into seats with glued upholstery.

DESCRIPTION OF THE INVENTION:

15 Said object is achieved by a heating element, the characteristics of which will become evident from the appended patent claim 1.

20 Said object is also achieved by a method for manufacture of a heating element, the characteristics of which will become evident from the appended patent claim 10.

DESCRIPTION OF THE DRAWINGS:

25 The invention will be described closer below, by means of a few embodiment examples, referring to the enclosed drawings, in which

Fig. 1 shows a perspective view of a heating element according to a first embodiment of the invention,

Fig. 2 shows a section through the heating element of fig. 1 along the line II - II,

Fig. 3 shows a corresponding perspective view of a heating element according to a second embodiment of the invention,

30 Fig. 4 shows an exploded perspective view of a cut-out section of a heating element according to a third embodiment of the invention,

Fig. 5 is a schematical view from above of a heating element according to the invention,

Fig. 6 shows, schematically, a plant for manufacturing of the heating element according to the invention, and

Fig. 7 shows, in cross section, a device for the manufacture of seat cushions according to the invention.

PREFERRED EMBODIMENTS:

- 5 As shown in figs.1 and 2, the heating element 1 according to the invention comprises a heating loop 2, laid out on a carrier 3, in the embodiment shown in figs. 1 and 2 consisting of a pair of foil layers 3, 4. The lower foil layer may be the carrier, but may also be joined with
10 another material which then is the carrier. The upper foil layer 4 constitutes more or less a protective or covering layer, which in certain cases is necessary for adding further adhesive agent and in certain embodiments is intended for removal prior to assembly in a vehicle seat.
- 15 At least one foil layer, preferably the lower one 3, consists in this first embodiment of a very thin foil of glue, e.g. on a polyamide base, being hydrophilic. Another alternative consists of polyester film, and a product example is a foil sold under the brand name of WW-22 from
20 Westwood Products, California, U.S.A. Also the upper foil layer may consist of the same material and if so may remain fixed during assembly into a vehicle seat, but may alternatively consist of a protective layer of paper or another fibrous material, non-woven, textile material or
25 similar. In this case, said layer is only used for handling of the heating element 1 during manufacture, stockholding and transportation and is to be removed prior to assembly into a vehicle seat.
- 30 The heating loop 2 may consist of an as such known, electrically conductive resistance wire, preferably a multiple-cable one in order to withstand a large number of flexures without risk of breakage. The wire may be uninsulated or may possibly have a plastic insulation
35 withstanding a higher temperature than the steam tempera-

ture necessary for the manufacturing process (see below). The heating loop consists of a closed loop having two connection leads 5, 6, which preferably terminate in a not shown connector device for connection to a not shown current source within the vehicle current supply system, comprising an alternator and a battery. The heating loop 2 may be deployed in various ways in order to distribute the generated heat optimally, and may preferably be supplemented by a previously known wave form.

The heating loop 2 is fastened to at least the lower foil layer by means of a bonding agent, e. g. a layer of glue, which also constitutes the bonding agent for adhesion of the upper foil layer 4 to the lower foil layer 3. The foil layer itself may also be used as a bonding agent through heating of the wire before it is deployed on the foil layer, so that a certain melting to a bonding effect is achieved. As can be seen from the first embodiment, the carrier, at least the lower foil layer 3, is air-permeable which is achieved in the shown embodiment through a large number of holes 7, which, in the case of having twin foil layers also when assembled, requires correspondingly located holes in the upper foil layer to enable air permeation through the entire heating element, between its bottom side and top side. In the case of an upper foil layer intended for removal, holes are not necessary in the top layer. Preferably, the holes are arranged not to coincide with the location of the heating loop 2.

Fig. 3 shows a second embodiment where the heating loop is carried by another type of latticed carrier, in this case consisting of a mesh or net 8, e. g. made of polyamide, polyester or similar. The heating loop 2 may also in this case be fixed to the net by means of a bonding agent in the form of glue. Also in this case there may be two layers arranged, i. e. a lower net and an upper net, to achieve a more secure fastening of the heating loop 2.

Referring to fig.4, the various components of the heating

element 1 are for clarity shown located at some distance from each other. In the finished heating element, the various components are in contact with each other.

5 In this embodiment example the heating element thus comprises a carrier layer 30, on one side of which a heating loop 2 is fastened by means of a bonding agent 31, shown in fig.4 as a layer of glue. In this example an adhesive film 3 constitutes the lower layer of the element, being
10 arranged against the opposite side of the heating loop. As will be clarified below, the adhesive film 3 also functions as a friction layer.

15 In the following, each component of the heating element 1 is described in further detail: The carrier layer 30 in this case consists of a porous air-permeable foam material. In the described embodiment example, polyethene foam having a thickness of 2 mm and a density of 30 kg/m³ is employed. It is important that the heating element 1 is at least as
20 flexible and stretchable as the vehicle seat upholstery 7, shown in fig. 6. This is so as to transmit also to the heating element those dimensional changes that occur in the upholstery layer due to the tool profile during manufacture, in order to avoid wrinkles and other
25 malformations. The profile of the vehicle seat may be relatively complex, resulting in three-dimensional deformations of the various parts of the heating element. As the carrier layer 30 constitutes the dimensionally dominating part of the heating element 1, it is thus of
30 outmost importance that also this part fulfills the flexibility demands. A decided advantage with the use of foam material for the carrier layer is furthermore that modern upholstery layers for vehicle seats often have an inside backing consisting of a thin layer of foam of
35 approximately the same thickness as the carrier layer. In this way, the mechanical and thermal properties of the heating element are brought to generally harmonize with those of the upholstery layer 7, as the carrier layer 2 mainly determines the total material properties of the

heating element 1, such as stiffness, flexibility and thermal expansion. The importance of these properties being compatible to a high degree with the properties of the upholstery layer 7 will be apparent from the brief
5 description of the manufacturing process for vehicle seats with glue-fixed upholstery layers given later in this description. In order for the heating element 1 to be used in said manufacturing process it is important that it is highly air-permeable. As the carrier layer in this case
10 consists of a thin, porous foam layer, a very good air-permeability is achieved which allows for that the heating element 1 does not impair the vehicle seat capability of "breathing" through the design.

15 The heating loop 2 consists of an as such known electrically conductive resistance wire. The wire may be uninsulated or may possibly be equipped with a plastic insulation.

20 Fig. 5 shows a heating element 1 where the heating loop 2 is deployed in a suitable pattern allowing elastic deformation of the heating loop in an arbitrary direction so as to withstand a large number of bendings and stretchings without the risk of breakage. the closed loop is equipped
25 with two connection leads 32, 33, which preferably terminate in a not shown connector device for connection to a not shown current source within the vehicle current supply system, comprising an alternator and a battery. The heating loop 3 may be deployed in various ways in order to
30 distribute the generated heat optimally, and may preferably show a similar wave pattern.

The heating loop 2 is fastened to the carrier layer 30 by means of a bonding agent, e.g. a glue layer 31 as shown
35 schematically in fig.4. The glue layer 31 could suitably consist of a melting glue, being adapted so as not to impair the air-permeability of the heating element 1.

A friction layer 3 is applied between the upholstery layer

7 and the heating loop 2. The friction layer is highly air-permeable and offers sufficiently high friction between the heating loop 2 and the inside of the upholstery layer 7 to mechanically transfer the deformations of the upholstery layer 7 to the the heating element 1 during the manufacturing process for vehicle seats with glued-on upholstery layer described below.

As will be seen from the embodiment of the invention shown in fig.4, the friction layer 3 is included as part of the heating element 1 and consists of an adhesive film applied to that side of the heating loop 2 which is turned towards the upholstery layer 7. The adhesive film is adapted principally to give an adhesive effect only after being subjected to heat, and is in this embodiment example fastened to the rest of the heating element 1 by means of the same glue layer that also fastens the heating loop 2 to the carrier layer 30.

However, a certain adhesive effect may be present in the friction layer 3 already from the start, so that it will adhere lightly to the inside of the upholstery layer 7.

In the finished heating element 1, all layers shown in fig. 4 are thus pressed together into one unit, held together by the glue layer 31, the adhesive film 3 still remaining in a non-melted form and therefore giving only a limited adhesive effect by itself. In it's non-melted form the adhesive film 3 is air-permeable and offers sufficiently high friction against the inside of the upholstery layer 7 to mechanically transmit the deformations of said upholstery layer 7 to the heating element 1.

In order to offer high air-permeability and high friction against contacted surfaces, the adhesive layer 3 shows for example a loose, fine-threaded mesh structure. The material of the adhesive film in the embodiment example is a polyamide adhesive agent, denominated SH 2402, from Applied Extrusion Technologies Ltd, Bristol, UK.

Fig. 6 shows, schematically, an example of a device for manufacture of the heating element according to the invention. The example is based on the alternative according to the first embodiment with two foil layers. One foil layer is stored in a storage reel 9, located at one end of the device. The device further comprises a station 10 for application of bonding agent, e.g. by spraying of glue on the top side of the foil layer 3. Following that is a station for deployment of the heating loop according to a pre-determined pattern. The foil layer thus forms a continuous path, supported by a belt conveyor 12, extending between the various stations. The second foil layer 4 is also devised as a path and arranged to uncoil from a storage reel 13. A conducting roller 14 is arranged, around which the second foil layer 4 is re-directed and attached to the first foil layer with the heating loop in between. Furthermore, a perforating device 15 is included, comprising e.g. a perforating roller 16 and a perforating knife 17. At the end of the device, a reel 18 is arranged for coiling of the manufactured and in path-form connected heating elements.

The manufacturing of the heating elements according to the embodiment example in fig. 6 is thus performed as follows:

From the storage reel 9 the lower foil layer 3 is continuously uncoiled and coated e.g. by spraying with a glue layer at the station 10 for application of bonding agent, after which the heating loop 2 is deployed at station 11 and fastened through glueing against the foil layer by means of the glue layer. The second foil layer 4 is also uncoiled continuously from its storage reel 13 and is attached by means of the conducting roller 14, after deployment of the heating loop, against the lower foil layer 3 with the heating loop in between. The foil layers are then perforated by the perforating roller 16, whereby also perforation edges are created by means of the perforation knife 17, said edges being spaced with a distance equal to that between two opposite edges of the heating

element, after which the connected heating elements are coiled onto the collection reel 18. Alternatively, the knife 18 may be a cutting knife for cutting of the heating elements into separate units which are piled in boxes for transportation to the plant for vehicle seat assembly. As touched upon above, adhesive action between the loop 2 and the foil layer 3 may be obtained by first heating the wire forming the heating loop so as to partly melt the foil layer 3 into stickyness. In this way the application of a separate glue layer may be omitted.

Fig. 7 shows schematically, by way of example, a section through a device for manufacture of seat cushions, i.e. back-rest and seat cushions for vehicle seats. The device and the method enlarges on the previously known technology of glueing the upholstery layer to the elastic body of a cushion. For example, a technology may be used here, which is described more closely in the European Patent o 227 202, rendering it unnecessary to describe that technology as such in detail. The device comprises in principle a mould 19 having a cavity, the inner surface 20 of which has the same shape as the cushion in question. The device further comprises a thrust plate 21, movable in the direction of the arrow 22, as well as in the opposite direction, by means of a not shown power actuator, e.g. an hydraulic or a pneumatic cylinder. Said plate is intended for applying a pressure against an already shaped elastic body 23, forming the core of the cushion and showing the same moulded surface as the inner surface of the mould 20. The core may consist of a conventional material, usually foam plastic, e.g. polyester or poyurethane foam. A number of ducts 25 are leading to the mould cavity, in the shown example arranged at the bottom of the mould and being connected to a vacuum device and a heating device, which may be switched into the ducts 25. In the space between the surface 24 of the elastic body 23 and the surface of the mould 20, an upholstery layer 26 made from an air-permeable textile material, e.g. based on an air-permeable foam plastic layer, is situated, and inside this is a glue foil

27 which may be of the same type and preferably from identically the same material as the carrier of at least one of the foil layers 3 of the heating element. Other layer thicknesses may of course occur. When using this
5 technology the foil layer 3, which in this case consists of a glue foil, and the glue foil 27, which covers the entire mould cavity, should be of such a character that the bonding effect of the glue foil is non-existent at a temperature below a pre-set temperature level, i.e. the highest
10 permissible working temperature of the heating loop, whereas the glue foil should melt when heated to a temperature which lies below the maximum allowed temperature of all other cushion components, such as the elastic body 23 and the upholstery layer 26, and of the heating
15 loop 2. By glue foil is thus meant such a layer which through its material properties, at least at a certain temperature, has a bonding effect without the need for separate, additional glue layers. An example of a glue foil is polyurethane foil, which when heated has a bonding
20 effect.

According to the invention the heating element 1 is located between the upholstery layer 26 and the glue foil 27 and thereby exhibits either one single layer, which is a glue
25 foil, in which case any covering layer is removed, or twin glue foil layers with the heating loop in between them.

During manufacture of the seat cushion according to the invention the following happens:

30 The upholstery layer 26 is placed in the mould and may consist of cut-out pieces or form part of a material path which is fed intermittently forwards over the mould cavity between operations. The glue foil may be fed in a
35 continuous path and be cut after the operation for continued intermittent forward feed. Through vacuum effect via the air ducts 25 the upholstery layer 26 and the glue foil 27 are sucked into close contact with the inside wall of the mould. This happens in spite of the glue foil having a

porous structure with a large number of microscopical holes, as these holes highly restrict the air passage. Subsequently the heating element 1 is placed in a predetermined position on top of the glue foil. The elastic
5 body 23 is then placed into the mould and a balanced pressure is applied by means of the thrust plate 21, the purpose of which is to press said body against the layers and the intermediate heating element. Then heat is introduced, by hot air via the air ducts 25, to a
10 temperature above the melting temperature of the glue foil 27, which entails that the glue foil is transformed into drops and diffuses into the adjacent layers, i.e. into the elastic body as well as into the upholstery layer 26. The same thing happens to the carrier in the heating element 1,
15 which melts, transforms into drops and diffuses into the adjacent layers, signifying that the heating loop is glued in between the adjacent layers and is fastened in position. Also during this heating stage the air flow is facilitated by the heating element being air-permeable. After the
20 elimination of vacuum and heat supply and after hardening of the glue the cushion is ready for finishing edgework etc.

The invention is not limited to the embodiment examples
25 described above and depicted in the drawings, but may be varied within the bounds of the appended patent claims. For example, the installation of the heating element is not bound to the technology described in the above reference but may be used in connection with other methods for
30 glueing of upholstery layers to elastic bodies in order to create cushions for vehicle seats. As an alternative to perforated foil layers and mesh structures the carrier may have another structure, e.g. be made of a porous material to be air-permeable and thereby allow passage and
35 distribution of the vacuum applied during the process by means of the vacuum device and distribute the inflowing hot air.

PATENT CLAIMS:

5

1. Heating element for vehicle seats comprising an electrically conductive heating loop (2) connectable to a current supply and a carrier (3) for said heating loop, characterized in that the carrier (3) is air-permeable and made from an electrically insulating, flexible material and in that the heating loop is deployed on the carrier and fixed in a definite position relative to the carrier.

10

2. Heating element according to claim 1, characterized in that the carrier (3) shows a mesh structure.

15

3. Heating element according to claim 1, characterized in that the carrier consists of at least one glue foil layer (3) having a plurality of through holes (7).

20

4. Heating element according to claim 3, characterized in that the carrier consists of two foil layers (3, 4) equipped with holes (7), adhering to each other with the heating loop (2) between them, the holes coinciding so that the two joined layers together are air-permeable.

25

5. Heating element according to claim 3, characterized in that at the melting temperature of said glue foil layers (3, 4) a bonding effect is triggered, which remains after a subsequent temperature reduction.

30

6. Heating element (1) for vehicle seats constructed from an elastic framework (9) and an upholstery layer (7), comprising an electrically conductive heating loop (2) connectable to a current supply, attached to an electrically insulating, air-permeable carrier layer (30),

35

where the heating loop is deployed in a pattern allowing elastic deformation in an arbitrary direction, characterized in

that the mechanical properties of the heating element (1) essentially correspond to those of the upholstery layer (7);

5 that a friction layer (3), forming a part of the heating element (1), is applied between the upholstery layer (7) and the heating loop (2), said friction layer being air-permeable and offering a sufficiently high friction between the heating loop and the inside of the upholstery (7) to mechanically transmit the deformations of the upholstery layer (7) to the other parts of the heating element (1).

7. Heating element (1) for vehicle seats according to claim 6,

10 characterized in that said friction layer (3) consists of an adhesive film being applied to that side of the heating loop (2) which is turned towards the upholstery layer (7), said film being arranged principally to create a bonding effect only after being subjected to heat, and in a non-melted condition being air-permeable and offering enough
15 friction against the inside of the upholstery layer (7) to mechanically transmit the deformations of the upholstery layer (7) to the other parts of the heating element (1).

20 8. Heating element (1) for vehicle seats according to the preceding claims, characterized in that said adhesive film (3) shows a fine-threaded mesh structure.

25 9. Heating element (1) according to claim 6, characterized in that said carrier layer (30) consists of a porous, air-permeable foam material.

10. Method for manufacture of a heating element (1) for vehicle seats, comprising an electrically conductive

heating loop (2) and a carrier (3) for said heating loop, characterized by the stages that

- a first glue foil (3) is uncoiled continuously in the shape of a first material path,
- heating loops are deployed with pre-selected spacing,
- 5 - a second foil (4) is uncoiled continuously in the shape of a second material path and is attached to the first material path with the heating loop in between, and it is provided for at least one material layer to be perforated across it's surface, and by that
- separation notches are created or alternatively separation into separate heating elements is performed.

11. Method according to claim 10, characterized in that provision is made also for said
10 second foil (4) to be perforated so that both foil layers together will be air-permeable.

12. Method for manufacture of a seat cushion for a vehicle seat, comprising the glueing of an upholstery layer (26) to
15 an elastic body (23), characterized in that a heating element, (1) in the form of a heating loop (2) and a carrier (3), is inserted between the upholstery layer (26) and the elastic body (23) and is fixed in a definite position by glueing, said glueing being
20 achieved by the insertion of a glue foil (27) between the upholstery layer (26) and the elastic body (23) and heating of the glue foil to achieve a bonding effect, and in that said heating element (1) with carrier in the shape of an extra glue foil (3) is inserted between the upholstery
25 layer (26) and the first glue foil, both the first glue foil and the extra glue foil being heated to achieve a bonding effect.

13. Method for manufacture of a heating element (1) for
30 vehicle seats built from an elastic framework (9) and an upholstery layer (7), the heating element (1) showing an

electrically conductive heating loop (2) connectable to a current supply, attached to an air-permeable carrier layer (30) and being deployed in a pattern allowing elastic deformation in an arbitrary direction,
5 characterized in that a friction layer (3) is applied between the upholstery layer (7) and the heating loop (2), said friction layer being air-permeable and offering enough friction between the heating element and the inside of said upholstery (7) to mechanically transfer the deformations of
10 the upholstery layer to the heating element (1).

14. Method according to claim 13,
characterized in that said heating element (1) and upholstery layer (7) are heated to achieve a bonding effect
15 of the friction layer (3) in order to fasten the heating loop (2) against the inside of the upholstery layer (7) in a definite position.

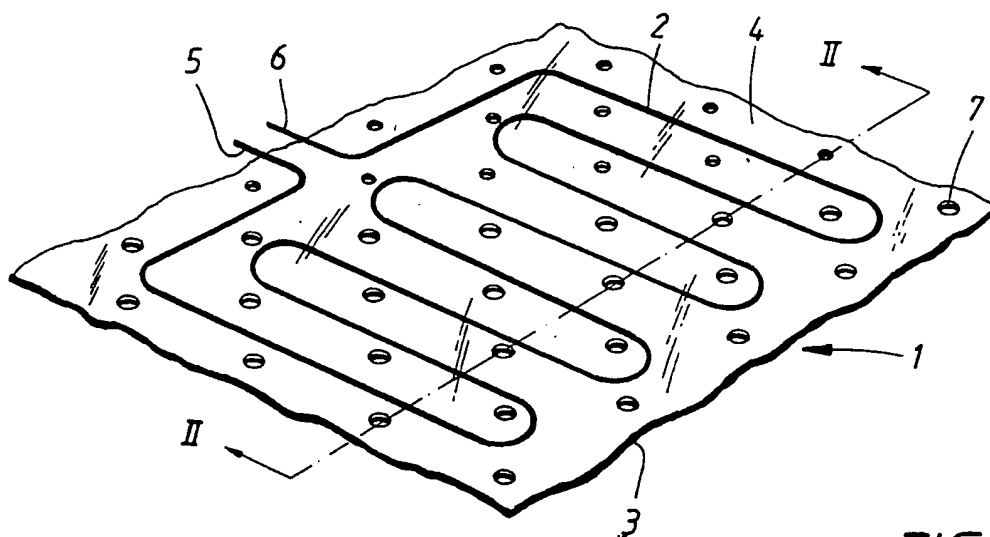


FIG. 1



FIG. 2

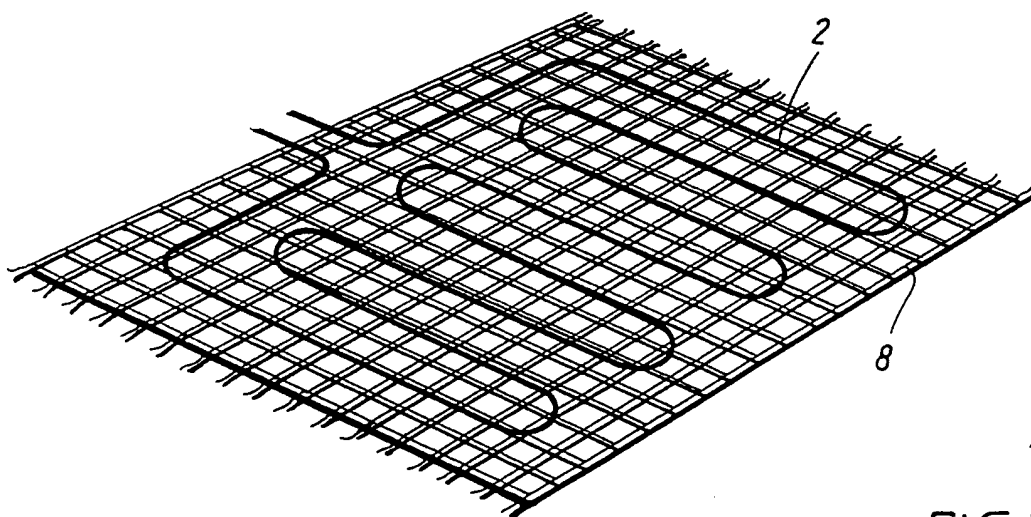
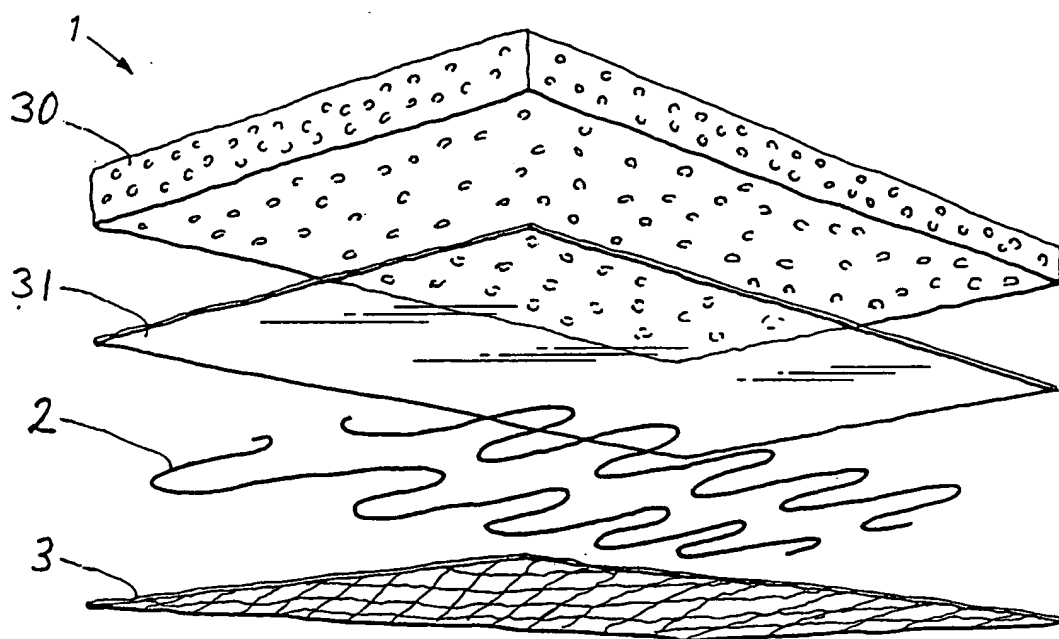
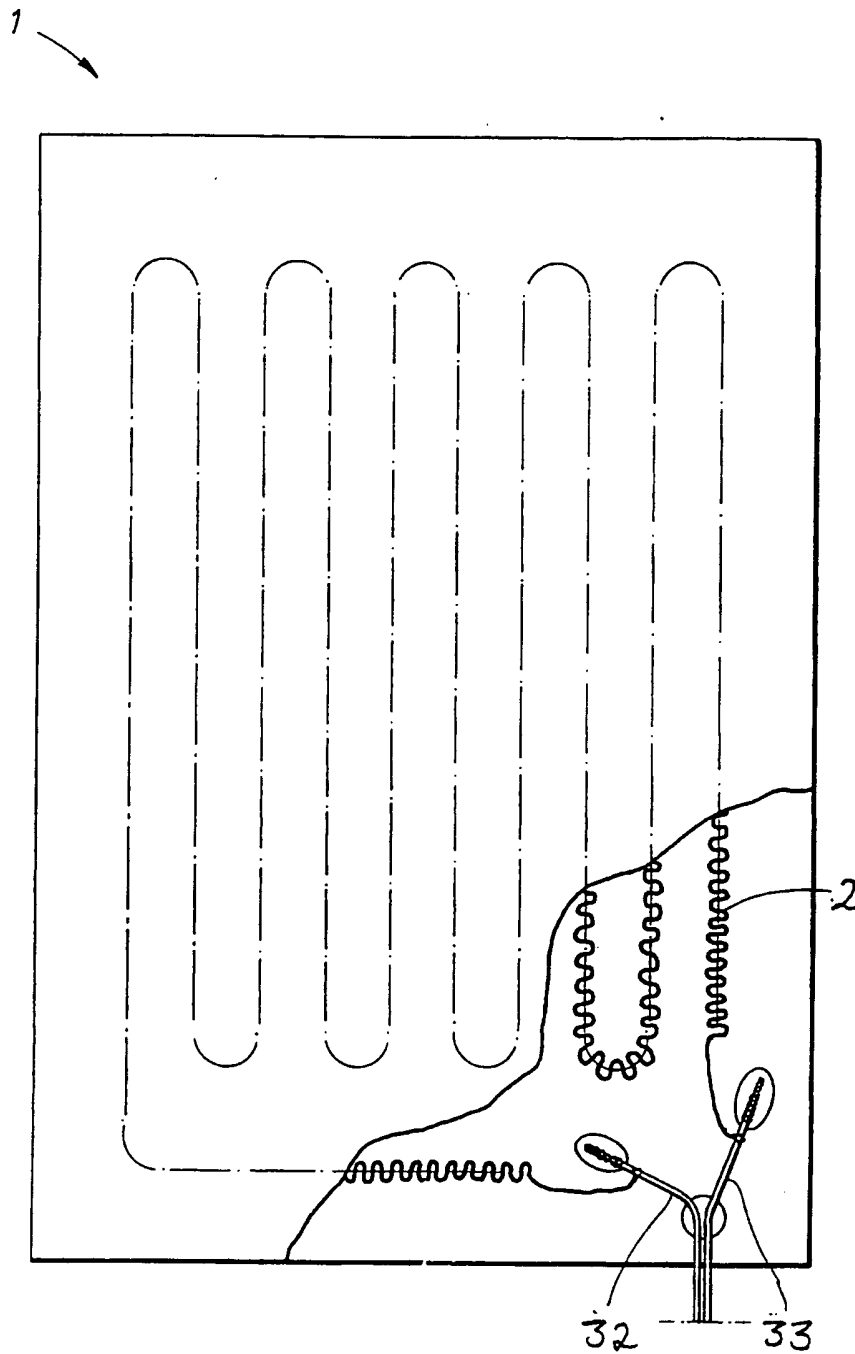


FIG. 3

FIG. 4

FIG.5

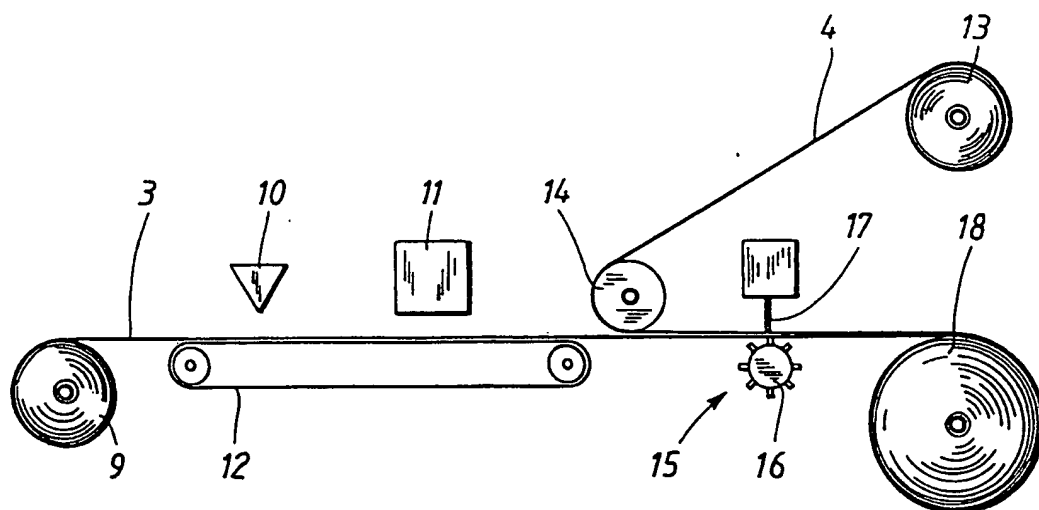


FIG. 6

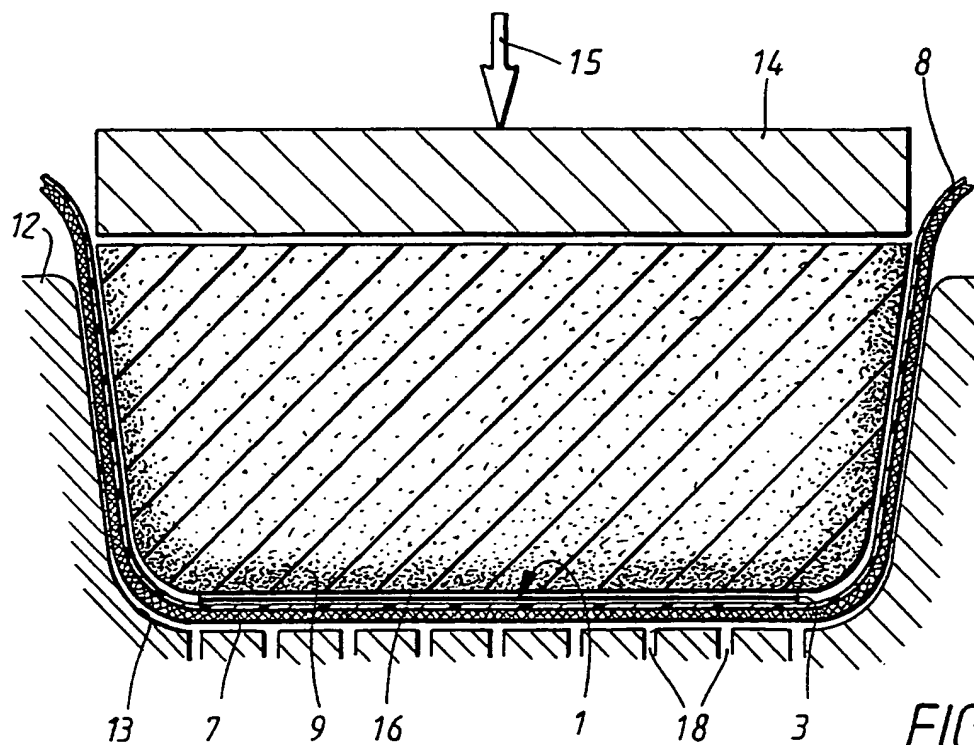


FIG. 7

1
INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 93/00896

A. CLASSIFICATION OF SUBJECT MATTER

IPC5: A47C 7/74, H05B 133/34

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC5: A47C, H05B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	SE, B, 434204 (BULTEN-KANTHAL AB), 9 July 1984 (09.07.84), page 2, line 36 - page 3, line 5, figure 1, claims 1-4	1-4
	--	
Y	US, A, 4044221 (KUHN), 23 August 1977 (23.08.77), column 2, line 20 - line 66, figure 1, claims 1-3	1-4, 12
	--	
Y	WO, A1, 9116841 (I.G. BAUERHIN GMBH ELEKTROTECHNISCHE FABRIK), 14 November 1991 (14.11.91), figures 1,1a-c	1,2
	--	
Y		10, 11
	--	

☒ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

1 February 1994

Date of mailing of the international search report

02 -02- 1994

Name and mailing address of the ISA/
Swedish Patent Office
Box 5055, S-102 42 STOCKHOLM
Facsimile No. +46 8 666 02 86

Authorized officer

C. Westberg
Telephone No. +46 8 782 25 00

INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 93/00896

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	GB, A, 2070400 (NORTHERN BLANKETS LIMITED), 3 Sept 1981 (03.09.81), figures 1-2, claims 1-15 --	10,11
Y	EP, A2, 0227202 (LEAR SIEGLER, INC.), 1 July 1987 (01.07.87), figures 1,6, claims 1-24 -- -----	6-9,12-14

INTERNATIONAL SEARCH REPORT

Information on patent family members

30/12/93

International application No.

PCT/SE 93/00896

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
SE-B- 434204	09/07/84	DE-A- 2850664 FR-A,B- 2410412 GB-A,B- 2010650 JP-A- 54081539 SE-A- 7713250	07/06/79 22/06/79 27/06/79 29/06/79 24/05/79
US-A- 4044221	23/08/77	SE-A- 7508229	20/01/76
WO-A1- 9116841	14/11/91	DE-A- 4014178 EP-A- 0491011	07/11/91 24/06/92
GB-A- 2070400	03/09/81	AU-A- 6794581 BE-A- 887654 CA-A- 1167507 DE-A- 3107011 FR-A,B- 2476467 JP-A- 56130096 NL-A- 8100978	03/09/81 15/06/81 15/05/84 24/12/81 28/08/81 12/10/81 16/09/81
EP-A2- 0227202	01/07/87	SE-T3- 0227202 AU-B- 565179 AU-A- 5733186 CA-A- 1268694 JP-C- 1723976 JP-B- 4007987 JP-A- 62146614 US-A- 4692199	10/09/87 18/06/87 08/05/90 24/12/92 13/02/92 30/06/87 08/09/87

**This Page is Inserted by IFW Indexing and Scanning
Operations and is not part of the Official Record**

BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

- ☐ BLACK BORDERS
- ☐ IMAGE CUT OFF AT TOP, BOTTOM OR SIDES
- ☐ FADED TEXT OR DRAWING
- ☒ BLURRED OR ILLEGIBLE TEXT OR DRAWING
- ☐ SKEWED/SLANTED IMAGES
- ☐ COLOR OR BLACK AND WHITE PHOTOGRAPHS
- ☐ GRAY SCALE DOCUMENTS
- ☐ LINES OR MARKS ON ORIGINAL DOCUMENT
- ☐ REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY
- ☐ OTHER: _____

IMAGES ARE BEST AVAILABLE COPY.

As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.

THIS PAGE BLANK (USPTO)